Vol. 29. Parts 5–6. Pp. 57–84. 56 figs. 8th July, 1960

THE PROCEEDINGS

OF THE

ROYAL ENTOMOLOGICAL SOCIETY OF LONDON

Series B

TAXONOMY

World List abbreviation: *Proc. R. ent. Soc. Lond.* (B)

CONTENTS

	PAGE
MURPHY, D. H. Some records and redescriptions of British Collembola. Part II, Symphypleona, with a description of *Bourletiella craggi* sp.n.	57–64, 34 figs.
WHALLEY, PAUL E. S. Notes on the North African species of the genus *Chrysocrambus* Bleszynski (LEPIDOPTERA : PYRALIDAE), with a description of a new subspecies	65–67, 3 figs.
CORBET, PHILIP S. A new species of *Afronurus* (EPHEMEROPTERA) and its association with *Simulium* in Uganda	68–72, 9 figs.
COE, R. L. A new *Syrphus* from Jugoslavia (DIPTERA : SYRPHIDAE)	73–74, 2 figs.
PARAMONOV, S. J. Notes on African species of *Eurycarenus* Loew and *Sisyrophanus* Karsch (DIPTERA : BOMBYLIIDAE)	75–76
SERVICE, M. W. A taxonomic study of *Anopheles funestus funestus* Giles (DIPTERA : CULICIDAE) from Southern and Northern Nigeria, with notes on its varieties and synonyms	77–84, 8 figs.
BOOK NOTICES	64, 74

LONDON

PUBLISHED BY THE SOCIETY AND

SOLD AT ITS ROOMS, 41, QUEEN'S GATE, S.W.7.

Price 9s. 6d.

THE ROYAL ENTOMOLOGICAL SOCIETY OF LONDON

Founded 1833. Incorporated by Royal Charter 1885.

Patron:
HER MAJESTY THE QUEEN

OFFICERS AND COUNCIL FOR THE SESSION, 1960–1961

Dr. B. P. Uvarov, C.M.G., F.R.S., *President*
Professor D. S. Bertram, Dr. J. S. Kennedy, Mr. E. O. Pearson } *Vice-Presidents*
Dr. N. E. Hickin, *Treasurer*
Dr. Paul Freeman, *Secretary*
Mr. W. H. Potts, *Editor*

Other Members of Council

Mr. R. B. Benson
Mr. R. G. Davies
Dr. A. M. Easton
Dr. L. G. Higgins
Dr. B. R. Laurence
Mr. H. Oldroyd
Professor G. C. Varley
Dr. N. Waloff
Mr. M. J. Way
Dr. C. B. Williams, F.R.S.

Miss E. Evans, *Registrar*

Finance and House Committee
Professor D. S. Bertram (*Chairman*)

Dr. C. G. Butler
Mr. J. P. Doncaster
Dr. R. M. Greenslade
Dr. D. J. Lewis
Mr. H. L. G. Stroyan

Publication and Library Committee
Mr. R. G. Davies (*Chairman*)

Dr. J. D. Carthy
Dr. H. E. Hinton
Mr. T. G. Howarth
Mr. D. Leatherdale
Mr. G. E. J. Nixon

Conservation (Insect Preservation) Committee
Mr. R. B. Benson (*Chairman*)

Dr. B. M. Hobby
Dr. A. M. Massee, O.B.E.
Mr. N. D. Riley, C.B.E.
Mr. F. T. Vallins
Mr. M. J. Way

The Executive Officers of the Society are *ex-officio* members of all Committees.

DELEGATES OF THE SOCIETY TO:

1. **British National Committee for Biology** (Royal Society).
   Mr. N. D. Riley, C.B.E., appointed 1955.
   Dr. H. E. Hinton, appointed 1958.
2. **Local Committee of Management of Wicken Fen.**
3. **National Trust for Places of Historic Interest or Natural Beauty.**
   Mr. N. D. Riley, C.B.E., appointed 1955.
4. **New Forest Association.**
   Mr. C. W. Mackworth-Praed, appointed 1948.
5. **New Forest Joint Committee.**
   Lt.-Col. F. C. Fraser, appointed 1949.
6. **Field Studies Council.**
   Dr. W. H. Thorpe, F.R.S., appointed 1944.
7. **Yorkshire Naturalists' Trust, Ltd.**
   Dr. W. D. Hincks, appointed 1946.
8. **The Biological Council.**
   Dr. N. E. Hickin, appointed 1952.
9. **The Parliamentary and Scientific Committee.**
   Dr. N. E. Hickin, appointed 1953.
10. **British Co-ordinating Committee for Nature Conservation.**
    Mr. E. B. Britton, appointed 1954.
11. **Council for Nature.**
    Dr. N. E. Hickin, appointed 1958.

SOME RECORDS AND REDESCRIPTIONS OF BRITISH COLLEMBOLA. PART II—SYMPHYPLEONA, WITH A DESCRIPTION OF *BOURLETIELLA CRAGGI* SP. N.

By D. H. Murphy

(*Dept. of Zoology, Durham Colleges in the University of Durham*)

This paper is a continuation of Part I of my " Records and Descriptions of British Collembola ", which immediately precedes it in these *Proceedings* (1960, **29** : 46–55). The summary, acknowledgments and literature cited, may be taken as applying to both parts.

Sminthurides cf. *parvulus* (Krausbauer)

In 1955 Salmon redescribed this species on the basis of material obtained from moss in woods at Long Compton, Warwick. Material has now been obtained from moorland in the north of England, which substantially agrees with Salmon's description and, although the proportions of the subsegments of antennal segment IV agree more closely with the data given for *S. quinquearticulatus* Gisin than with Krausbauer's figures, the present author supports Salmon's identification on account of the highly characteristic mucro. Since I differ from Salmon in my interpretation of this structure, and since no previous information has been given on the male, an extended description is given here.

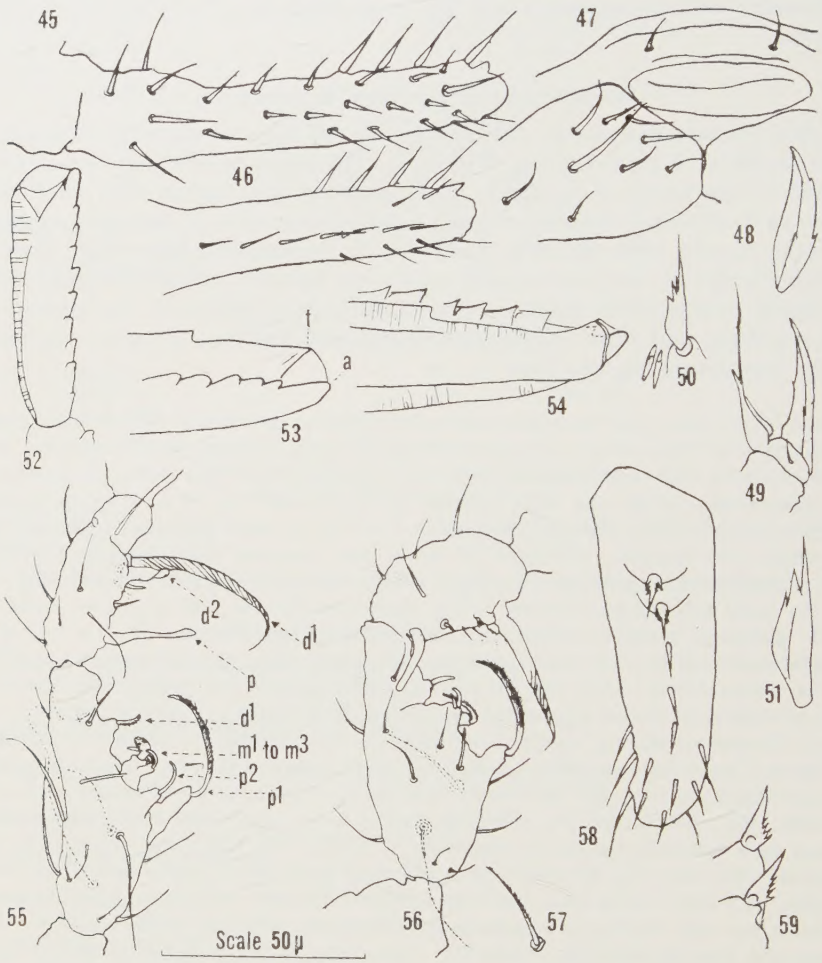
Female.—0·45 mm. (All measurements in the following description refer to this specimen.) Body globular and high-arched, with segmentation of thoracic region almost obsolete. Longest posterodorsal setae (the most posterior seta of the medial row is that measured, but the setae of the posterodorsal group are fairly uniform among themselves) 50 μ, subequal to mucro; anterodorsal setae (medial setae of metathoracic fold) 37 μ; pregenital setae of female (fig. 47) 1 + 1, simple and straight. Antennae 1·3 times head diagonal, with segments I–IV 26 : 40 : 77 : 146 μ respectively. Antenna IV with 5 simple subsegments 43, 22, 24 and 35 μ respectively, the basal subsegment therefore being approximately one and a quarter times length of apical; subapical sensillum cylindrical, curved, smaller than in male. Ocelli 8 + 8, of which 2 are represented only by very small corneoles. Leg I with tibia, outer edge of claw and EA[1] 96, 34 and 34 μ respectively; claw (fig. 49) narrow, with inner and one pair of lateral teeth (these difficult to observe in lateral aspect but discernible from above); EA with lamina 18 μ and subapical filament extending beyond inner edge of claw, slightly thickened subapically but narrowing to a fine acuminate point. Leg II with tibia, claw and EA as 83, 30 and 32 μ respectively; claw slightly shorter and less slender than on leg I, with 2 pairs of lateral teeth and one inner tooth; EA with lamina 15 μ, relatively shorter than on leg I and with filament relatively longer and more distinctly thickened subapically. Leg III with tibia, claw and EA 114, 30 and 32 μ respectively; claw (fig. 48) with 2 pairs of lateral teeth clearly visible from above, without inner tooth; EA with lamina 16 μ, and long subapical filament which is simple and acuminate. Tibiotarsal organ with 2 subequal vesicles and guarding seta, which is basally lamellate; lamella terminates in 2–3 lateral teeth (figs. 50 and 51). Dens 112 μ with dorsal chaetotaxy as in figure 45, ventral as in figure 46. Inner lateral row of 4 thickened setae, of which the most distal and longest is 19 μ, less than half mucro. Mucro (figs. 52 and 54) very characteristic, broad and trough-shaped. I fully support the interpretation originally placed on this structure by Krausbauer. The trough-like shape is due to a much broadened outer lamella, which is supported distally by a tooth-like thickening ("*t*" in fig. 53), beyond which a thin membranous continuation of the lamella extends to the apex of the main shaft (*a*). In the female this is reflexed and hood-like (fig. 52) which, in lateral aspect, may give the impression of a recurved tooth. There was no evidence of an outer sheathing tunica, but this may be because the outer and ventral lamellae

[1] Empodial appendage.

both arise from the apex of the shaft and therefore give an appearance of continuity under certain conditions of orientation. Inner lamella with 7–9 coarse teeth ; outer lamella with one large tooth at about 0·7 ; ventral lamella narrow, simple and extending to apex of shaft. Mucronal seta absent. Ventral tube with 1 + 1 setae and without apical papillae. Tenaculum with 3 + 3 barbs on rami and 2 anterior setae on corpus, the corpus short and with the seta corresponding to the apical in some species absent. One pair of basal clavate appendages.

Male.—0·37 mm. Most characteristics as in female, except for the usual secondary sexual features. Fewer teeth on mucro and filaments of anterior EA less distinctly thickened subapically ; mucro (fig. 53) with apex of outer lamella not hooded ; metanotal vesicles present ; antennal clasping organ as in figure 55.

In figure 55, an attempt has been made to classify the processes of the male antennal organ into proximal, median and distal groups on each segment. The male of *parvulus* is peculiar in the presence of a supplementary papilla on which a spine (p^2) in the proximal group of seg. II



Figs. 45–59.—(45 to 55) *Sminthurides parvulus* (Krausbauer) : (45) Dens, dorsal chaetotaxy, × 1 ; (46) dens, ventral chaetotaxy, × 1 ; (47) lower anal valve and pregenital setae, × 1·5 ; (48) claw III, oblique dorsal view to show lateral teeth, × 1·2 ; (49) claw I, lateral view, × 1·2 ; (50) tibiotarsal organ, × 1·2 ; (51) guarding seta of another specimen, × 2·5 ; (52) mucro of female, dorsal view, × 1·5 ; (53) Mucro of male, ¾ view, × 2·5 ; (54) mucro of female, full lateral view, × 2·5 ; (55) clasping organ of male, × 1. (56 and 57) *Sminthurides* cf. *signatus* (Krausbauer) : (56) Clasping organ of male, × 1 ; (57) serrate bothriotrichium from ant. seg. II of male. (58 and 59) *Sminthurides* sp. innominata : (58) dens, ventral view, × 1·5 ; (59) serrate setae from dens in lateral view, × 2·5.

(All magnifications quoted are relative to the scale included in the figure.)

is borne, and in the great enlargement of the middle sensillum of the median group of three. There is also a thickened seta (d^2), in the distal part of this segment. The bothriotrichia are both smooth. Proximally on seg. III the sensillum is very elongate. The main spine of the distal group (d^1) is spirally grooved to the base and the outer member of the group (d^2) is long and smooth. On the inner side of the main spine is a small conical peg. Ant. seg. IV is simple, with a wide emargination at the apex, in which lies a stout, curved sense rod.

The above description makes it clear that *parvulus* is a distinctive and easily recognised species. The absence of mucronal seta and the peculiar shape of the mucro, together with the quinquearticulate antennal segment IV and the presence of four setae in the inner lateral row of the dens, make it easily separable from allied forms. The lateral teeth of the claws are probably distinctive, but this character is a very difficult one to verify and is not recommended for use in a dichotomous key. The male clasping organ suggests a very close affinity with *S. schötti*.

Material

Widespread in *Sphagnum* and *Calluna* peat soils in the Moor House National Nature Reserve, Westmorland, near Alston.

Material from Long Compton, Warwicks., deposited by Dr. Salmon in the British Museum (Nat. Hist.), has also been referred to in the preparation of this description.

Sminthurides (s. str.) sp. innominata (? in the *S. schötti* group)

A number of specimens have been obtained in which the chaetotaxy of the dens is so peculiar as to leave no doubt that it belongs to a species as yet undescribed. Since, however, the material is so juvenile that many essential features of the adult cannot be determined, I prefer at present to leave the form unnamed. It has, however, been considered worthwhile to draw attention to its existence, in the hope that other workers will pay attention to this characteristic when identifying species of this genus.

The form is strongly characterised by the modification of the two proximal ventral setae of the dens (figs. 58 and 59) into broad, serrate spines. Furthermore, the inner bothriotrichium of the genital segment is long and slightly flexuose at the tip. Otherwise, the specimens have been compared with material of the same size of *S. schötti* and features such as the lack of segmentation of antennal segment IV, and the slight development of the lamella on the guarding seta of the tibiotarsal organ are of no systematic significance at this stage.

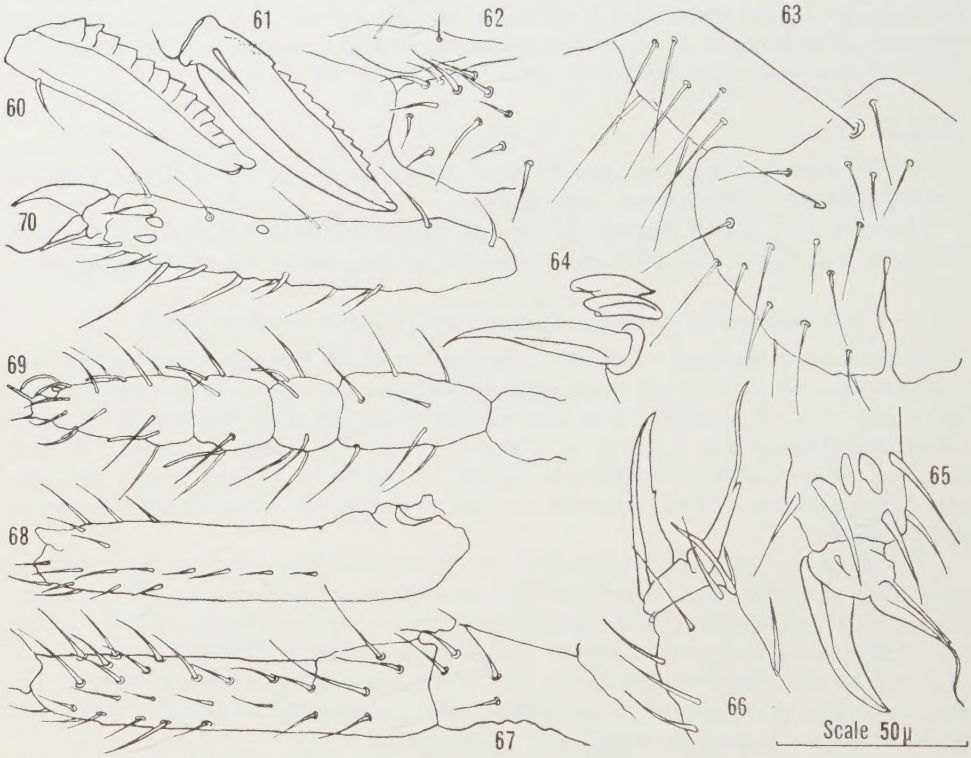
N. Wales : Carnedd moel Siabod, 31.iii.51, turf from beneath snow at mountain peak, six juvenile individuals.

Sminthurides cf. *signatus* (Krausbauer)

The type form of this species has been a source of confusion for some time owing to doubts as to the range of variation in the proportions of the antennal segments. Material has now been obtained which agrees closely with the description given by Krausbauer except in the coloration and habitat. With slight reservations on these latter grounds, therefore, a description of this material is given here under Krausbauer's name.

Length up to 0·45 mm. Coloration deep purple-red throughout including antennae, legs and furca ; this pigmentation is dark enough to require clearing before the specimens can be satisfactorily examined. Body globular, with 3 + 3 bothriotrichia on furcal segment and 2 + 2 on anogenital segment. Longest posterodorsal setae 38 μ, slightly shorter than mucro ; anterodorsal setae 30 μ ; longest setae of anogenital segment 34 μ. Inner bothriotrichium of anogenital segment short, spine-like (fig. 63). Pregenital setae of female (fig. 62) 1 + 1, simple and tapering. Antennae 1·16 times head diagonal, with segments 21, 40, 55 and 125 μ respectively ; Ant. IV divided into 4 simple subsegments which are 38, 19, 21 and 46 μ respectively, from base to apex,

the apical subsegment, therefore, being distinctly longer than the basal (fig. 69). This relationship is consistent throughout the whole of the material examined. Ocelli 8 + 8, of which 2 are reduced. Leg I with tibia, outer edge of claw and EA 95, 28 and 28 μ respectively ; claw (fig. 66) with distinct inner tooth and outer tooth ; EA with basal lamina 14 μ and subapical filament simple, exceeding the claw. Leg II with tibia, claw and EA 87, 27 and 27 μ respectively with claw and EA similar to that of leg I. Leg III (fig. 70) with tibia, claw and EA 118, 28 and 27 μ respectively ; claw (fig. 65) without teeth, EA with broad lamella and subapical filament simple and exceeding the claw. Tibiotarsal organ with proximal vesicle slightly the smaller and guarding seta compressed but without a well-developed lamella or lateral tooth (fig. 64). Furca with chaetotaxy as in figures 67 and 68, having 3 setae in the inner lateral row, of which the most distal is 18 μ long ; outer lateral row of 5 short setae. Dens 114 μ and mucro 42 μ. Mucro (figs. 60 and



FIGS. 60–70.—*Sminthurides* cf. *signatus* (Krausbauer) : (60) Mucro, dorsal view, ×1·6 ; (61) mucro, lateral view, ×1·6 ; (62) lower anal valve and pregenital setae, ×1 ; (63) anogenital segment, lateral view, ×1 ; (64) tibiotarsal organ, ×2·6 ; (65) claw III, ×1·6 ; (66) claw I, ×1·6 ; (67) dens, dorsal view, ×1 ; (68) dens, ventral view, ×1 ; (69) ant. seg. IV, ×1 ; (70) tibiotarsus III, ×1.

61) with narrow inner lamella bearing 12–13 teeth, and with narrow outer lamella having a tooth one-third from the base and terminating in a blunt outer tooth, some distance before apex of main shaft. Ventral lamella simple, entire and extending to apex of shaft ; mucronal seta present ; ventral tube with 1 + 1 strong setae and with 4 + 4 conical papillae ; tenaculum with 3 + 3 teeth on rami and 2 anterior setae on corpus ; 1 + 1 basal clavate appendages.

Male.—Size 0·27 mm. Coloration as female. Agrees in most particulars with female. Metathoracic vesicles present ; clasping organ of antenna (fig. 56) with most distal of inner bothriotrichia of Ant. II short, stouter than the proximal and unilaterally fringed (fig. 57). In the position corresponding to p^2 in *parvulus* is a thickened seta which is not, however, situated on a papilla ; group *m* consisting of 3 sensilla of which m^1 (the most anterior) markedly longer than the others. On Ant. III, proximal sensillum long and hyaline ; median sensillum short and conical ; main spine (d^1) strong and spirally striated only in distal half ; d^2 short and with a toothed section distally and at its base a small conical sensillum.

WESTMORLAND : Moor House Nature Reserve, common in loose eroded peat.

Arrhopalites principalis Stach, 1945

WESTMORLAND : Moor House Nature Reserve, near Alston, regularly recorded from peat soils and *Sphagnum* during 1953 and 1954, always in small numbers.

This appears to be the first British record under this name, although many of the previous records of *A. binoculatus* (Wankel) will certainly refer to this species.

Sminthurinus niger (Lubbock) *sensu* Stach, 1956

Material from a variety of localities in England has been checked against Stach's description and I am satisfied that the common British form usually referred to as *S. niger* is indeed conspecific with Stach's species, and the probability is that his description applies to Lubbock's original species. British material has short maxilla head and the fifth segment of the abdomen clearly delimited from both the furcal and anal segments.

WARWICKSHIRE : Coventry, 5.iv.51. HERTFORDSHIRE : Harpenden, Rothamsted Experimental Station grounds, in material from a tree hollow. WESTMORLAND : Moor House National Nature Reserve, near Alston, 10.ix.53, under stones and on surface of outcropping limestone.

Bourletiella (s. str.) *viridescens* Gisin, 1948

In all material so far examined of the yellow *Bourletiella* (s. str.), usually referred to as "*B. lutea*" Lubbock, the male dorsal organ of abd. VI (figs. 71, 72 and 74) corresponds exactly with that illustrated by Stach (1956) for *hortensis*. The postero-dorsal setae of the furcal segment (fig. 73) are, however, hooked and thickened. Gisin (1957) has shown that Stach's species is, in fact, that referred to *B. viridescens* by Gisin in 1948. Owing to the discrepancy in structure referred to above and to the fact that my material is limited to the north of England and to Eire, I am not prepared to state categorically that *viridescens* is a synonym for *B. lutea*. Since, however, the form is widely distributed in the British Isles, the possibility undoubtedly exists that the resolution of the existing controversy may lie along the following lines :

(*a*) That the form recognised by Stach as conspecific with the nearctic *B. arvalis* Fitch is indeed that species, as is also the material referred to *B. lutea* by Jeannenot (1954). This seems to be the common pest species and is not unlikely to occur on both continents. It may be noted that Jeannenot's material was taken from lucerne. (*b*) That the material described by Gisin (1946) as *lutea*, later referred by him to *viridescens* and then, in 1956, described by Stach as *hortensis*, is, in fact, the original *B. lutea* of Lubbock.

The final solution of this problem depends on a better knowledge of the *Bourletiella* in the south of England, where it is not unlikely that *B. arvalis* will also occur.

In figures 71, 72 and 74 illustrations are given of the dorsal organ of British and Irish material.

WESTMORLAND : Moor House National Nature Reserve, near Alston, Cumberland, 18.vii.53, and subsequent occasions, sweeping *Festuca* grassland. YORKSHIRE : Brough, 21.vii.55, grassland near Fish Lake.

Bourletiella (s. str.) *hortensis* sensu Jeannenot, 1954 et Gisin, 1957, non *sensu* Stach, 1956

As the above qualifications indicate, mere quotation of the name is not sufficient to indicate the presence of this species. The following records of this much recorded species are included to show that the form which is recognised by Gisin (1957) under this name (having the two lateral hooks of the dorsal organ elongate and divergent) also occurs in England.

PEMBROKESHIRE : Dale, 17.ix.51, on ground in farmyard. WESTMORLAND : Moor House National Nature Reserve, nr. Alston, Cumberland, 20.vi.53, on stones in areas of advanced peat erosion. YORKSHIRE : Weetwood Hall, 13.vii.53, damp gravel at roadside.

Bourletiella (Heterosminthurus) craggi sp. n.

In 1956, Stach introduced the use of the occipital organ of the male for the separation of the species of the *bilineata* group. In 1957, Gisin figured the occipital organ of Swiss material of *B. bilineata* (Bourlet) and to judge by the notes given by

FIGS. 71–78.—(71–74) *Bourletiella viridescens* Gisin : (71) male dorsal organ, ×2·4, specimen from Moor House Nature Reserve, Westmorland ; (72) male dorsal organ, ×2·4, specimen from Fish Lake, near Brough, Yorkshire ; (73) posterodorsal setae from same specimen ; (74) male dorsal organ, ×2·4, specimen from Clifden, Eire. (75–78) *Bourletiella craggi* sp. n.: (75) occipital chaetotaxy of male, ×1 ; (76) lower anal valve of female, ×1 ; (77) occipital organ of male, lateral view, ×1 ; (78) the same, oblique view, ×1.

him (1948) on its distribution and ecology (" Espèce constante des prairies plus ou moins humides, de plaine et de montagne . . . ") he is likely to have encountered the same species as that which Bourlet (1841) described from France (" Sur l'herbe des prairies."). British material up to now recorded under this name is of an abundant and highly characteristic species on *Callunetum* and upland moorland, but which has not been encountered from lowland meadows.

Male.—Occipital organ (figs. 77 and 78) extremely distinctive, posterior setae being thickened and apically expanded into a flattened lamina ; laminae lie pressed together between anterior

setae, which are long and sinuate ; setae of frons short and basally swollen, as in *bilineata* sensu Gisin.

No means have yet been found of distinguishing the females of this species from *B. bilineata*. Perianal chaetotaxy agrees with figure given by Gisin (1946) ; dorsodistal macrochaeta of dens only half length of mucro and dental chaetotaxy agrees with figure given by Stach (1956). Coloration identical with that given by Stach for *B. bilineata*.

It gives me great pleasure to dedicate this species, probably one of the most widespread and characteristic species of British moorlands, to Professor J. B. Cragg, of the University of Durham, who has supervised and encouraged my work on the Moor House National Nature Reserve.

Holotype ♂, *allotype* ♀, and ♂ and ♀ *paratypes*, WESTMORLAND : Moor House National Nature Reserve, near Alston, Cumberland, 17.viii.55, swept from *Calluna*, Bog Hill. The types will be deposited in the British Museum (Nat. Hist.).

Bourletiella (*Heterosminthurus*) *cornuta* Stach

YORKSHIRE : Garsdale, 6.viii.55, on mixed grassland edging the railway line.

The coloration of this material, *when living*, agrees with the description of Stach. The occipital organ is exactly as figured, and the male lacks the cuticular processes anterodorsally on the body which characterise the superficially similar *B. nonlineata* Gisin. No hesitation is felt in referring this material to Stach's species.

Bourletiella (*Deuterosminthurus*) *sulphurea* (Koch, 1840) *sensu* Gisin, 1946, 1957

YORKSHIRE : Garsdale, 6.viii.55, on mixed grassland edging the railway line. EIRE : Clifden, Connemara, 17.vii.54, on grassland.

Bourletiella (*Deuterosminthurus*) *flava* Gisin, 1946

YORKSHIRE, Brough : 21.vii.55, swept from *Holcus mollis–Pteridium* ass. under trees at foot of Swindale Beck.

This record may be added to that of Goto (1955 *Ent. mon. Mag.* **91** : 267).

SUMMARY

Two forms new to science are described, *Micranurida conjuncta* and *Bourletiella craggi*. Redescriptions are given of *Hypogastrura scotica*, *Anurida thalassophila*, *Onychiurus halophilus*, *O. stachi*, *Tetracanthella brachyura*, *Sminthurides parvulus* and *S. signatus*. *O. paucisetosus* Hammer is sunk as a synonym of *O. stachi* and *O. spinularius* as a synonym of *O. edinensis*. Records, in some instances with figures and/or taxonomic notes, are given for *Anurida comellinii*, *Pseudanurophorus binoculatus*, *Folsomia montigena*, *Isotoma scapellifer*, *Arrhopalites principalis*, *Sminthurinus niger*, *Bourletiella viridescens*, *B. hortensis*, *B. cornuta*, *B. sulphurea*, and *B. flava*. A new name, *Hypogastrura gotoi* is proposed.

ACKNOWLEDGMENTS

The author is grateful for the supervision and encouragement of Professor J. B. Cragg and for the help and advice of Dr. H. Gisin (Muséum d'Histoire Naturelle, Geneva). Dr. T. Clay (British Museum (Natural History)) gave extensive help and advice for which I am especially grateful. Mr. H. E. Goto and Mr. D. K. Choudhuri (Imperial College of Science) have given advice on specific problems. The authorities of the British Museum (Natural History) and the Nature Conservancy provided facilities for study. Most of the work was carried out during the tenure of a Nature Conservancy Research Studentship.

References

Bagnall, R. S., 1935, Contributions towards a knowledge of the Scottish Onychiuridae (Collembola), I. *Scot. Nat.* **214** : 111–7.

—— 1937, Contributions towards a knowledge of the Scottish Onychiuridae (Collembola), II. *Ibid.* **1937** : 87–90, 145–50.

—— 1939, Notes on British Collembola. *Ent. mon. Mag.* **75** : 188–200.

—— 1940, Notes on British Collembola. *Ibid.* **76** : 97–102 ; 173–74.

—— 1949, Notes on British Collembola. *Ibid.* **85** : 57–61.

Bourlet, l'Abbe, 1841, Mémoires sur les Podurides et les Sminthurides. *Bull. Soc. ent. Fr.* **10** : xl–xli, lvii–lviii.

Gisin, H., 1944, Materialen zur Revision der Collembolen II. Weiteres Basler Material. *Mitt. Schweiz. ent. Ges.* **19** : 121–56.

—— 1946, Révision des espèces suisses du genre *Bourletiella* s. lat. (Collembola). *Ibid.* **20** : 249–61.

—— 1948, Etudes écologiques sur les Collemboles épigés. *Ibid.* **21** : 485–515.

—— 1949, Notes sur les Collemboles avec description de quatorze espèces et d'un genre nouveaux. *Mitt. schweiz. ent. Ges.* **22** : 385–410.

—— 1952, Notes sur les Collemboles avec démembrement des *Onychiurus armatus*, *ambulans* et *fimetarius* auctorum. *Ibid.* **25** : 1–22.

—— 1953, Collembola from Jan Mayen Island. *Ann. Mag. nat. Hist.* (12) **6** : 228–34.

—— 1955, *Proisotoma* (*Isotomina*) *scapellifera* n. sp. (Collembola). *Mitt. schweiz. ent. Ges.* **28** : 140

—— 1957, Sur la faune européenne des Collemboles. I. *Rev. suisse Zool.* **64** : 475–96.

Goto, H. E. 1957, Some further Collembola from Shillay, Outer Hebrides. *Scot. Nat.* **69** : 1–10.

Hammer, M., 1953, Investigations on the microfauna of northern Canada. II. Collembola. *Acta arct. Kbh.*, **6** : 1–108.

Jeannenot, F., 1954, Contribution a l'étude des Collemboles. Révision de deux espèces du genre *Bourletiella* récoltées en Côte-d'Or. *Trav. Lab. Zool., Dijon.* **4** : 1–16.

Krausbauer, T., 1905, Beiträge zur Kenntnis der Collembola in der Umgegend von Weilburg an Lahn. *Ber. oberhess. Ges. Nat.- u. Heilk.* **34** : 29–104.

Salmon, J. T., 1955, Two Collembola Symphypleona new to Britain. *Ent. mon. Mag.* **91** : 241–2.

Stach, J., 1949, The Apterygotan fauna of Poland in relation to the world-fauna of this group of insects. Families : Neogastruridae and Brachystomellidae. *Acta monogr., Cracoviae* **2** : 1–341.

—— 1956, The Apterygotan Fauna of Poland in relation to the world-fauna of this group of insects. Family : Sminthuridae. *Ibid.* **6** : 1–287.

Book Notices

Dragonflies. By Philip S. Corbet, Cynthia Longfield and N. W. Moore. 8vo. London (Collins), 1960. Pp. xii+260, text illust. [*New Naturalist.*] £2 2*s.* 0*d.*

This latest volume in the *New Naturalist* series is the work of three naturalists who have made wide and varied studies of the Odonata both in this country and abroad.

The present work deals with the 43 British species and covers, in addition to their life-history, such aspects as their fossil history, dispersal, seasonal fluctuations and their relationships with man and other animals. The chapter on the distribution of the British species is illustrated with 40 maps.

There are appendices on venation, methods of preservation and of marking, and a glossary of terms, as well as a " Key to the larvae of the British Odonata ", by A. E. Gardner, illustrated with 118 line drawings ; the whole work is beautifully illustrated with black and white and colour photographs depicting an original series of field studies.

NOTES ON THE NORTH AFRICAN SPECIES OF THE GENUS *CHRYSOCRAMBUS* BLESZYNSKI (LEPIDOPTERA: PYRALIDAE), WITH A DESCRIPTION OF A NEW SUBSPECIES

By Paul E. S. Whalley

(*Department of Entomology, British Museum (Natural History)*)

Bleszynski in his 1958 paper revised the genus *Chrysocrambus* and brought together much information previously scattered throughout the literature. This valuable work has formed a basis for the rearrangement of the genus in the British Museum collection. Bleszynski, however, did not have all the types available and as a result a few errors have occurred. Many of the types are in the British Museum and the following discussion is based on them.

Subgenus *Chrysocrambus* Bleszynski

Chrysocrambus mauretanicus Müller-Rutz

1931, *Mitt. schweiz. ent. Ges.* **15** : 36.
Chrysocrambus tingitanellus Chrétien, Bleszynski *nec* Chrétien, 1958, *Acta Zool. Cracov.* **2** : 861.

This is a good species. It is accurately illustrated by Müller-Rutz (1931) and the type and paratypes are in the British Museum.

The shape of the juxta varies considerably from short and stout to long and thin (figs. 1 and 2). The aedeagus has a spine inside which also varies and, in the two extremes, constitutes a considerable difference. The species is known to vary considerably (Marion, 1950*b*), and several incipient species are included under *C. mauretanicus* as subspecies. There is a subspecies which has a juxta intermediate in shape between the two extreme forms (figs. 1 and 2, *cf.* fig. 3).

Although a few intermediates may be found between the three subspecies in a large collection, it is usual to be able to place most of the specimens (over 95 per cent.) into one or other of the subspecies. Apparently a cline could be based on the shape of the genitalia, but it is not possible to decide on available evidence whether the cline is geographical, ecological or seasonal.

Chrysocrambus mauretanicus major M.-R.

1931, *Mitt. schweiz. ent. Ges.* **15** : 37, pl. 1, fig. 96.

This subspecies is exactly intermediate in shape of the juxta between *mauretanicus* and the next subspecies. Type in British Museum (Nat. Hist.).

Chrysocrambus mauretanicus marioni ssp. nov.

C. tingitanellus Chrétien, Bleszynski *nec* Chrétien, 1958, *Acta. zool. Cracov.* **2** : 861, fig. 8.
Crambus mauretanicus M.-R. f. *ambustellus* M.-R., 1931, *Mitt. schweiz. ent. Ges.* **15** : 37, pl. 1, fig. 10.
Chrysocrambus tingitanellus Chrétien ab. *ambustellus* M.-R., Bleszynski, 1958, *Acta. zool. Cracov.* **2** : 862.

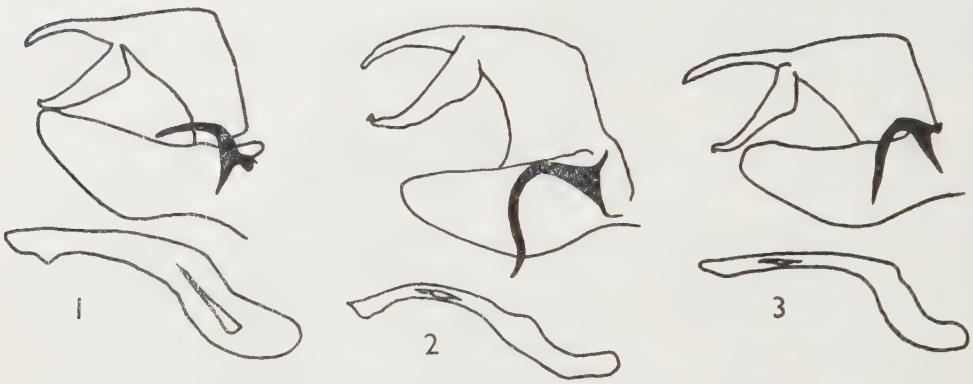
Type ♂, Algeria. Lambeze. L. Bleuse. Juin 1885. Paravicini Coll.
Type in British Museum (Nat. Hist.).

Paratypes, ♂, (all *ex* Paravicini Coll.).
Algeria. Djebel Aures, Balou. 24 Mai à 9 Juin 1913. Karr.
Algeria. Lambeze. J. Merkl. Juin 1884.
Khenchela (Prov. Constantine). H. Powell. Juin 1908.
Algeria. Lambeze. Mai 1914. Sari Aamar.

Khenchela (Prov. Constantine). H. Powell. Mai 1908.
Bône. J. Merkl. Juin 1884.
Algeria. Lambeze. L. Bleuse. Juin 1885.
Bône. J. Merkl. Juin 1884.
Algeria. Lambeze. L. Bleuse. Juin 1885.

The inner transverse band is usually thicker than in *C. mauretanicus* but this does vary to some extent. It is not possible to separate this subspecies on external characters alone.

The juxta is long and narrow and the aedeagus has a small spine in it.



FIGS. 1–3.—*Chrysocrambus :* male genitalia, lateral view, of (1) *mauretanicus* M.-R., (2) *mauretanicus major* M.-R., (3) *mauretanicus marioni* subsp. n.

Chrysocrambus chrysonuchelloides (Rothschild) **comb. nov.**

Crambus craterellus subsp. *chrysonuchelloides* Roths., 1925, *Bull. Soc. Sci. nat. Maroc.* **5** : 151.
Crambus maghrebellus Marion, 1950, *Rev. franç. Lépid.* **12** : 267, pl. 8, fig. 7, **syn. nov.**

This is a very distinct species. The genitalia are figured by Marion (1950*b*). The type of *chrysonuchelloides* Roths. is in the British Museum (Nat. Hist.).

Chrysocrambus chrysonuchelloides rungsellus (Marion) **comb. nov.**

Crambus maghrebellus rungsellus Marion, 1950, *Rev. franç. Lépid.* **12** : 267, pl. 8, fig. 8.

Externally this is one of the most striking members of the whole *Chrysocrambus* complex. The spines on the tip of the aedeagus in this species vary in number.

Chrysocrambus lambessellus Caradja, 1910

Bleszynski, 1958, *Acta zool. Cracov.* **2** : 858.
Crambus craterellus var. *lambessellus* Caradja, 1910, *Dtsch. ent. Z.* " Iris." **24** : 112.
C. similimellus M.-R., 1931, *Mitt. schweiz. ent. Ges.* **15** : 38, pl. 1, figs. 8, 19. (Type in British Museum.)
C. similimellus f. *umbrosellus* M.-R., 1931, *Ibid.* **15** : 38, pl. 1, fig. 9. (Type in British Museum.)

This species is correctly illustrated by Bleszynski (1958). The male genitalia separate it easily from other members of the *Chrysocrambus* complex. The species appears to be confined to Tunisia.

Subgenus *Chrysocramboides* Bleszynski
Chrysocrambus (*Chrysocramboides*) *kobelti* Saal

1885, *Stettin. ent. Ztg.* **46** : 335.
Crambus tingitanellus Chrétien, 1922, Oberthur *Étude Lép., Rennes.* **19** : 327 **syn. nov.**, (Lectotype in Paris.)

C. tingitanellus Chrét. has been synonymised with *mauretanicus* M.-R. on the basis of an illustration in Müller-Rutz's paper (1931). I have now examined Chrétien's original specimens. They are identical with the illustration of *kobelti* Saal given by Müller-Rutz (1931), but I have not seen the type of *kobelti*. This species has been collected in Prov. Constantine and Morocco (*Oued Dida*).

Although a few female specimens of the *Chrysocrambus* complex from N. Africa are included in the Museum collection, there are not enough to decide with which particular species they are associated. It would appear that the females are very rare in collections ; among a very large collection of *Chrysocrambus* from N. Africa in the Museum less than 1 per cent. are females.

Acknowledgments

Dr. H. Marion, Nièvre, has examined a great deal of the material used in this study. He has given much advice and assistance on this very complicated problem and I am extremely grateful to him for the time he has spent in helping me. I am also grateful to Dr. P. Viette, Paris, who has helped me with this problem. The illustrations were drawn by Mr. M. Shaffer.

References

Bleszynski, S., 1957, Studies on the Crambidae, Part XIV. *Acta zool. Cracov.* **1** : 161–622.
——, 1958, Studies on the Crambidae, Part XVIII. Revision of the Genus *Chrysocrambus* Blesz. *Ibid.* **2** : 846–884.
Chrétien, P., 1922, Gallerinae, Crambinae, etc. *in* Oberthür, Les Lepidoptères du Maroc. *Étude Lép.*, Rennes **19** : 327.
Marion, H., 1950*a*, Contribution à l'étude des *Crambus* paléarctiques II. *Rev. franç. Lépid.* **12** : 236–240.
——, 1950*b*, Contribution à l'étude des *Crambus* paléarctiques. III. *Ibid.* **12** : 261–277.
Müller-Rutz, J., 1931, Über einige alte und neue *Crambus* arten. *Mitt. schweiz. ent. Ges.* **15** : 38.

A NEW SPECIES OF *AFRONURUS* (EPHEMEROPTERA) AND ITS ASSOCIATION WITH *SIMULIUM* IN UGANDA

By Philip S. Corbet

On 28th March, 1959 my wife and I spent a few minutes collecting lithophilic insects in the Sebwe River, Toro, Uganda. Our collection was made at the point where the main Kasese–Fort Portal road crosses the river, some 10 miles from Kasese. There the river is about 10–15 metres wide and takes the form of shallow rapids. Although the altitude is probably no more than 1300 metres, the water is extremely cold, having descended abruptly from the eastern foothills of the Ruwenzori Mountains. We collected from a spot where people wash and obtain water, and where the rate of flow is less than that of the main river. Clinging to the surfaces of submerged stones were larvae of Plecoptera and Ephemeroptera. Among the latter were some large Heptageniidae, several of which bore pupal cocoons and pupae of *Simulium*. A few minutes after sunset the same evening three of these larvae disclosed adults. It is the purpose of this paper to describe the adults and larvae of this mayfly, and to remark upon its association with *Simulium*. I name this species after my wife.

Family Heptageniidae

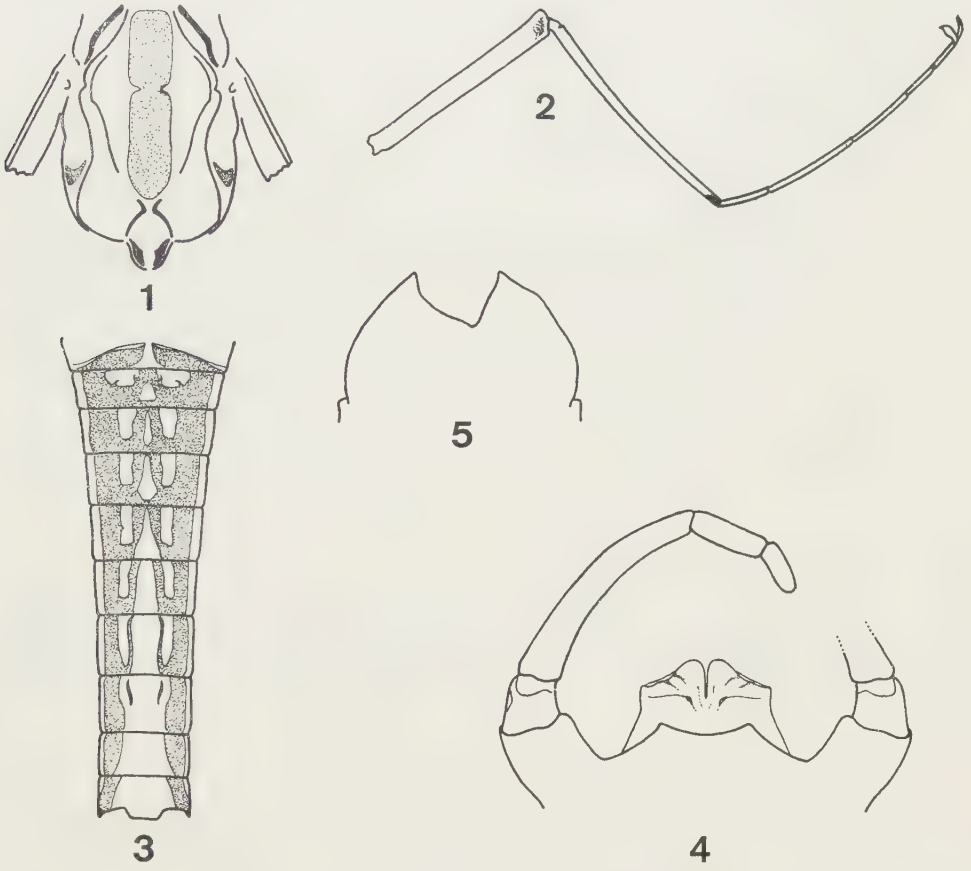
Afronurus negi sp. n.

In subimaginal characters, this species closely resembles *Afronurus pulcher* Ulmer (1930), of which no male imagines are known. Recently, however, Demoulin (1956) has placed *pulcher* in the synonymy of *A. collarti* (Navás). If Demoulin is correct, the species described here must be regarded as new, since it differs markedly from *collarti* in imaginal characters. In the male of *A. negi* the fused penis-lobes lack the paired digitate projections present in *collarti* (as figured by Demoulin), and the distal margin of the tenth sternite is distinctly concave instead of being convex as in *collarti*. The female differs from that of *collarti* in that the subanal plate possesses a deep terminal sulcus flanked by pointed tips, instead of being smoothly convex.

Imago. (Figs. 1–5)

Male.—Head pale yellowish-brown; compound eyes grey, ocelli pearly-white, rimmed with grey at base, especially of central ocellus; clypeo-frontal ridge marked with purplish-brown, particularly above bases of antennae; ventral margin of clypeus heavily, and longitudinal carinate ridge lightly, marked with purplish-brown. Thorax pale yellowish-brown, with broad mid-dorsal longitudinal band of darker brown; otherwise marked with well-defined small purplish-brown streaks, dorsally as in figure 1, and laterally below fore wing bases and near coxae. Wings hyaline, venation very pale yellow except for purplish-brown marks on basal half of costa and on costal wing brace. Legs yellowish-brown; all femora with reddish-brown spot at apex; tarsi uniformly coloured; in legs 2 and 3 slightly darker than tibiae; fore tarsus (fig. 2) with first joint shorter than second or third but longer than fifth; hind tarsus much shorter than femur or tibia; first joint of hind tarsus slightly shorter than second. Abdomen (fig. 3) pale yellowish-brown with broad longitudinal bands of magenta occupying about half the width of each tergite; these bands bear three white markings which become more extensive posteriorly, and have coalesced by about segment VIII; cerci marked strongly with magenta on 6 basal segments only, distally only on segmental sutures; forceps (fig. 4) robust, unmarked, 4-segmented; penes (fig. 4) united, with a broad apical cleft; markedly concave on dorsal surfaces; pale yellowish-brown marked slightly on protuberances with purplish-brown; posterior margin of tenth sternite between forceps bases of characteristic form. Length of fore wing 11·5 mm.

Female.—Resembles male except in following respects: compound eyes purple and grey; antennae yellowish-brown, unmarked; wings with venation orange-brown, the costa, subcosta and radius being particularly strongly coloured; purplish-brown line along edge of costa up to about three-quarters of its length. (Mid-legs missing in allotype.) Fore tibiae unmarked; tarsi uncoloured, same colour as tibiae, segments nearly equal: in order of length (fore) second, first, fifth, third, fourth; (hind) fifth, first, second, third, fourth. Pale central abdominal markings more extensive than in male, becoming more or less confluent from segment IV posteriorly, and occupying progressively more of dark tergal area; cerci pale magenta on basal 8–10 segments; thereafter magenta progressively restricted to basal ring; subanal plate prominent with a deep terminal sulcus flanked by pointed tips: sulcus asymmetrical in allotype (fig. 5); whole plate curves downwards. Length of fore wing 15·5 mm.



Figs. 1–5.—*Afronurus negi* sp. n., imaginal characters: (1) male thorax, dorsal view; (2) male fore leg; (3) male abdomen, dorsal view; (4) male forceps, forceps base and penes, ventral view (right forceps omitted); (5) female subanal plate, ventral view.

Subimago

Male.—General ground colour pale cream; dorsum of thorax with 2 longitudinal dark brown streaks converging slightly posteriorly, and 2 dark brown anterior spots; abdominal pattern light magenta, identical with that of imago; bases of cerci bright magenta. Form of penes and posterior margin of tenth sternite recognisably similar to that of imago and differing from *A. pulcher* (as figured by Ulmer) as follows: penis-lobes with mesial protuberances demarcated less from main lobes and apical cleft not so deep; posterior margin of tenth sternite broadly concave, instead of broadly convex with a central incision.

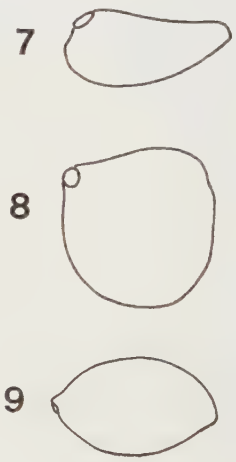
Material.—♂ type, ♀ imago and ♂ subimago allotypes, Uganda: Sebwe River, Toro, 28.iii.1959. Specimens in British Museum (Nat. Hist.).

LARVA. (Figs. 6–9)

Closely resembles larva of *Afronurus ugandanus* Kimmins (Corbet, 1960) in body-shape and habit, but differs from it in size, abdominal pattern and shape of gills. Dimensions, to nearest half mm., of final instar larvae, male and, in brackets, female : body-length 12 (14) (24·5 (28·5) including cerci) ; head-width 4 (4) ; wing-sheaths 3·5 (4·5). Abdominal pattern resembles that of *A. ugandanus* in so far as the same segments are pale, but differs from it and from *A. peringueyi* (Esben-Petersen) (*see* Barnard, 1932) in the shape of the markings (fig. 6). Gills differ from those of *A. ugandanus* only in shape, as shown in figures 7–9 ; those on V and VI lack apical filaments.

Material.—2 ♂, 1 ♀, which disclosed type and allotype imagines, and allotype subimago ; 1 ♂, 2 ♀ final instar larvae ; two penultimate instar and two smaller larvae, UGANDA : Sebwe River, Toro, 28.iii.1959. Specimens in British Museum (Nat. Hist.).

6



FIGS. 6–9.—*Afronurus negi* sp. n., larval characters : (6) diagram of abdomen and part of thorax, dorsal view, showing abdominal pattern and site of attachment of *Simulium* pupal case ; (7–9) shapes of gills on segments I, II and VII, respectively, right side posterior view (filaments on I and II omitted).

Association with Simulium

Altogether ten larvae of *Afronurus negi* were collected, and five of these each bore one pupal cocoon of *Simulium*. In three cocoons pupal exuviae were still present. One detached larva of *Simulium* was also present amongst the material, but probably became detached after capture.

Two pupal exuviae were in good condition and could be identified according to the characters given by Freeman and de Meillon (1953). The abdominal armature conformed exactly with both forms of *Simulium copleyi* Gibbins and with *S. diceros* Freeman and de Meillon ; the respiratory filaments agreed with those of *S. copleyi* form *marlieri* Grenier in being branched near their apices, but there were about 40, instead of 30, terminal filaments. However, giving due consideration to the other characters, the pupae can be assumed to be *S. copleyi* form *marlieri*. This material remains attached to the *Afronurus* larvae deposited in the British Museum (Nat. Hist.).

Of the *Afronurus* larvae which bore *Simulium* pupal cases, four (2 ♂, 2 ♀) were in the final instar and one was in the penultimate instar. All the final instar larvae were pharate, and three (2 ♂, 1 ♀) emerged on 28th March. The remaining larva

(♀) was killed on 29th March, but obviously soon would have emerged. The five other *Afronurus* larvae showed no signs of *Simulium* attachment. These comprised two final instar (♂♀, both pharate), one penultimate, and two earlier instars (6 and 7 mm. long).

The pupal cases were all attached to *Afronurus* larvae as shown in figure 6, four being on the left, and one on the right side. Each was attached to the wing-sheath. On final instar larvae the anterior part of the pupal case extended very slightly on to the dorsum of the thorax. On the penultimate instar larva, which has a smaller wing-sheath, the pupal case extended correspondingly further on to the thorax. This position is the same as that recorded for this species when attached to larvae of undetermined species of *Afronurus* and *Baëtis* (Marlier, 1950). Since the mayfly larvae customarily face upstream, the *Simulium* pupae must face downstream, as is usual for free-living members of the genus (Freeman and de Meillon, 1953).

In phoretic associations of this kind, attention has sometimes been drawn to the need for emergence of the two partner species to be synchronised, or at least temporally related. Thus the chironomid, *Epoicocladius ephemerae* Kieffer, postpones its pupation until after the emergence period of its semivoltine host, *Ephemera danica* L. In this way the helpless pupae are prevented from arriving prematurely at the water surface and being carried downstream (Gillies, 1951). In the first published account of phoretic association between *Simulium* and mayfly larvae, Marlier (1950) remarked that pupae and pharate final instar larvae of *Simulium* were always found on final instar or pharate mayfly larvae. Van Someren and McMahon (1950), describing a similar association, stated that the *Simulium* " always pupates after the *Afronurus* has completed its last nymphal moult ", and that, on the same night, " the emergence of both adults takes place in the hours of darkness within an interval of one or two hours ". Freeman and de Meillon (1953) review these reports and refer to the " remarkable timing of eclosion to coincide, within an hour or two, with that of the final nymphal moult of the mayfly ".

It is surprising, however, that in such examples of phoresis there should be any necessity for emergence to be synchronised. Although strictly comparative data are lacking, there can be very little doubt from published accounts (*e.g.* Freeman and de Meillon, 1953 ; Harker, 1952 ; Macan, 1957 ; Needham, Traver and Hsu, 1935) that *Simulium* develop much more rapidly than Heptageniid mayflies. If this is so, and unless for some reason young larvae of *Afronurus* are unsuitable for attachment, there seems no reason *a priori* why the *Simulium* should not complete its development significantly earlier than the mayfly. As in the situation described by Gillies (1951), it would seem that the *Simulium* is exposed to no danger by developing *faster* than the mayfly, but only by maturing *later*—when it would be liable to get swept downstream on the mayfly larval exuvia.

Recent observations tend to support this interpretation. Berner (1954) found a pupa, or pupal cocoon, of *S. berneri* Freeman on an *Elassoneuria* larva which was not yet in the final instar. Also, I have recently examined specimens from the Victoria Nile at Jinja, in which pupae of *S. lumbwanus* de Meillon were attached to penultimate instar larvae of *Afronurus ugandanus* Kimmins (*see* Corbet, 1960). And in the material described here, an empty pupal case of *S. copleyi* form *marlieri* occurred on a penultimate instar larva of *Afronurus negi* ; and furthermore, the four other pupal cases found on larvae had all been vacated before emergence of the mayfly. Thus it seems that, in these cases at any rate, *Simulium* can develop more rapidly than, and emerge before, the mayfly to which it is attached, and that therefore no synchronisation is necessary.

When the problem is viewed in this light, the precise timing of emergence reported by Van Someren and McMahon (1950) becomes all the more remarkable. If further work could reveal the ecological factors which necessitate such synchronisation, it is certain that they would prove of great biological interest.

Acknowledgments

I am very grateful to Mr. D. E. Kimmins of the British Museum (Natural History) for his comments on the adult material described here.

Summary

1. The adult and larva of a new species of mayfly, *Afronurus negi*, are described and figured.

2. The association of larvae of *A. negi* with immature stages of *Simulium copleyi* form *marlieri* Grenier is recorded and discussed.

3. It is concluded that in certain instances a synchronised emergence of the two insects involved in such an association is unnecessary.

References

Barnard, K. H., 1932, South African may-flies (Ephemeroptera). *Trans. R. Soc. S. Afr.* **20** : 201–59.

Berner, L., 1954, Phoretic association between a species of *Simulium* and a mayfly nymph, with a description of the nymph. *Ann. Mag. nat. Hist.* (12) **7** : 116–21.

Corbet, P. S., 1960, Larvae of certain East African Ephemeroptera. *Rev. Zool. Bot. afr.* **53** (*in press*).

Demoulin, G., 1956, Revision de quelques Ephéméroptères décrits du Congo belge par L. Navás. II. *Bull. Ann. Soc. ent. Belg.* **92** : 44–52.

Freeman, P. and De Meillon, B., 1953, *Simuliidae of the Ethiopian Region.* British Museum (Nat. Hist.), London.

Gillies, M. T., 1951, Association of a chironomid (Diptera) larva with *Ephemera danica* L. (Ephemeroptera). *Ent. mon. Mag.* **87** : 200–1.

Harker, J. E., 1952, A study of the life cycles and growth-rates of four species of mayflies. *Proc. R. ent. Soc. Lond.* (A) **27** : 77–85.

Macan, T. T., 1957, The life histories and migrations of the Ephemeroptera in a stony stream. *Trans. Soc. Brit. Ent.* **12** : 129–56.

Marlier, G., 1950, Sur deux larves de *Simulium* commensales de nymphes d'Ephémères. *Rev. Zool. Bot. afr.* **43** : 135–44.

Needham, J. G., Traver, J. R. and Hsu, Y., 1935, *The biology of mayflies.* New York.

Ulmer, G., 1930, Entomological expedition to Abyssinia, 1926–27 : Trichoptera and Ephemeroptera. *Ann. Mag. nat. Hist.* (10) **6** : 479–511.

Van Someren, V. D. and McMahon, J., 1950, Phoretic association between *Afronurus* and *Simulium* species, and the discovery of the early stages of *Simulium neavei* on freshwater crabs. *Nature, Lond.* **166** : 350–1.

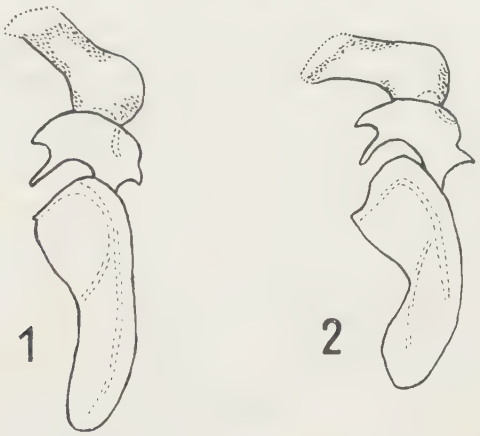
A NEW *SYRPHUS* FROM JUGOSLAVIA (DIPTERA : SYRPHIDAE)

By R. L. Coe
(*British Museum (Natural History)*)

Syrphus novigradensis sp. n.

Male.—Resembling *latifasciatus* Macquart, from which among other characters (given below) the completely yellow femora and shorter body-pubescence distinguish it. As in that species, distinguished from the allied *luniger* Meigen and *latilunulatus* Collin by tergites 3 and 4 having upper margin of the broad yellow bands or lunulate spots only very slightly undulating and situated rather close to base of tergites. In *luniger* and *latilunulatus* the upper margin of these bands or spots is considerably undulating and well removed from the base of tergites. These latter two species have the femora partly darkened as in *latifasciatus*.

Length, exclusive of antennae, 9·5 mm. ; wing-length 8 mm. Eyes bare, actually touching for about one and a half times length of ocellar triangle (in *latifasciatus* the eyes actually touch for about length of ocellar triangle). Occiput narrower than in *latifasciatus*, with hairs much



Figs. 1–2.—Penis of *Syrphus* : (1) *latifasciatus* Macquart ; (2) *novigradensis* sp. n.

paler yellow. Frons yellow, golden-dusted on basal half, which is clothed with upright rather shortish black hairs ; these continue weakly down sides of frons until just below base of antennae, leaving the well-defined frontal lunule and an approximately equal area above it bare. Face yellow, short yellow-haired, upper mouth-edge narrowly orange. Antennae with first and second segments reddish, third black above and at tip, broadly reddish below, and (measured inside) obviously longer than first and second segments together (in *latifasciatus* the third segment (measured inside) is not longer than first and second together). Arista short, reddish, scarcely longer than third antennal segment. Mesonotum greenish-black, brightly shining, pubescence short, yellow, with posterior thoracic callus clear orange-yellow on about anterior half, greenish-yellow behind (in *latifasciatus* the mesonotum is dullish, and the posterior thoracic callus entirely greenish-yellow). Scutellum light orange, dull, disc with short yellow hairs, margin with fringe of longish yellow hairs. Tergites with dull black ground colour, fringed sublaterally from middle of second tergite with short black hairs ; tergite 2 with large paired subtriangular yellow spots which reach over lateral margins for anterior half of tergite and are covered laterally with long yellow hairs ; 3 and 4 with broad yellow bands, apparently almost bare, the upper margin scarcely undulating except moderately at middle, posteriorly slightly convex with a moderate median incision, reaching over the otherwise black side-margins for about anterior third of tergite. Sternites 2–4 clear yellow, with a small roundish black central spot (in *latifasciatus* the black marking on sternites 3 and 4 is large, spreading transversely). Pre-genital segment and genitalia

small, and inconspicuous. Legs yellow, except coxae and trochanters darkened (in *latifasciatus*, besides the darkened coxae and trochanters, the 4 anterior femora have at least basal third darkened, posterior femora have at least basal half darkened, and at least posterior tarsi are often darkened dorsally). Four anterior femora have a short posterior fringe of yellow hairs, while the hind pair are closely covered behind, except towards base, with tiny black hairs. Wings pellucid, stigma light yellowish-brown. Squamae greyish, fringed with moderately long golden hairs. Halteres yellow. The genitalia differ from those of *latifasciatus* in the shape of the penis (figs. 1 and 2).

Type ♂, Dalmatia : Novi Grad, from polje in valley, 27–31.v.1958 (*R. L. Coe*). In the British Museum (Nat. Hist.).

Book Notices

Annual Review of Entomology. Vol. 5. Edited by E. A. Steinhaus and R. F. Smith. 8vo. Palo Alto (Annual Reviews Inc.), 1960. Pp. vii+451, text illust. $7.00.

During the five years since this Review commenced publication, 102 summaries and analyses covering various aspects of entomological progress have appeared in its pages. The latest volume contains the following articles :

Insect flight muscles and their basic physiology, E. G. Boettiger.
Insect micromorphology, G. A. Edwards.
Neurosecretion in insects, W. G. Van der Kloot.
The physiology of excretion in the insect, R. Craig.
Cytogenetics of insects, S. G. Smith.
Chromosomal variation and adaptation in insects, A. B. da Cunha.
The phylogeny of Coleoptera, R. A. Crowson.
Northern biting flies, B. Hocking.
Evolution and biology of the termites, F. M. Wessner.
Biology of fruit flies, L. D. Christenson and R. H. Foote.
Host selection in phytophagous insects, A. J. Thorsteinson.
Some recent contributions to the study of the distribution and abundance of insects, H. G. Andrewartha and L. C. Birch.
Sampling insect populations, R. F. Morris.
The use of honey bees in the production of crops, F. E. Todd and S. E. McGregor.
The biological background of locust control, D. L. Gunn.
Mechanisms of resistance against insecticides, A. W. A. Brown.
Some aspects of the application of insecticides, R. J. Courshee.
Citrus insects and mites, L. R. Jeppson and G. E. Carman.
Pesticides in relation to public health, W. J. Hayes.
Biological relationships between lice (Anoplura) and microbial agents, F. Weyer.

It has, in addition to its own author and subject indices, cumulative indices of the authors and titles of the contributions to the first five volumes.

NOTES ON AFRICAN SPECIES OF *EURYCARENUS* LOEW AND *SISYROPHANUS* KARSCH (DIPTERA: BOMBYLIIDAE)

By S. J. Paramonov

(*Commonwealth Scientific and Industrial Research Organisation, Canberra, A.C.T., Australia*)

[Communicated by H. Oldroyd]

Among material in the British Museum the author has found a new species of *Eurycarenus* Loew, and a female of *Sisyrophanus abdominalis* Bezzi, previously known only from the male. They are described below with remarks on other species of the genera, as a further contribution to our knowledge of the African Bombyliidae.

Eurycarenus subater sp. n.

Male.—Differs from other species in having almost all body hairs black.

Eyes touching for a distance nearly as long as ocellar triangle; facets at line of contact clearly greater than those at hind border. Proboscis at least twice as long as head; labellum equal to one-third of head length; palpi very short, thin, blackish; whole head dusted dense yellowish; occiput, face and underside of head with dense yellowish hairs; ocellar triangle, frons, antennae with long erect black hairs, similar hairs interrupted on face. Antennae black, very long and thin, at least as long as head; first and second segments conical, at base narrower, first one and a half times longer than second; third twice as long as first two together, with comparatively very long style, consisting of two small joints, of which second at least twice as long as first.

Mesonotum predominantly black haired, the yellowish intermingled hairs barely visible, although rather numerous; bristles on mesonotum and scutellum long, strong, and black; hairs on scutellum as on mesonotum. Underside of thorax predominantly yellow haired, black hairs intermingled on anterior and middle areas. Halteres dark, knob with yellowish tip; before and above base of halteres a large tuft of long yellow hairs. Wings hyaline, at base a little darkened; alula very well developed, darkened, as broad as anal cell, nearly semicircular; vein *r-m* placed nearly as in *Systoechus*, a little more distally; vein r_{2+3} appears broken in the middle. Legs black, with very strong black bristles on distal half of hind femora and hind tarsi; metatarsi nearly as long as other four joints together. Abdomen with very long and dense, predominantly black hairs and bristles; the first tergite, however, covered with yellowish hairs; third tergite with two triangular spots of yellowish hairs on the sides, which form, in the middle, an interrupted transverse band; under these yellow hairs similar but depressed hairs also present; hind part of third tergite occupied by a black triangle with apex reaching to anterior margin; fourth tergite with a round spot of yellow hairs on middle of hind margin; underside of abdomen black haired; upper genital lamellae (plates) yellowish.

Length of body, 10·5 mm.; wing, 10 mm.

Nigeria: Ibadan, 1 ♂, 12.x.1935 (*F. D. Golding*). Type in British Museum (Nat. Hist.).

In order to show the systematic position of this species an abbreviated key to the genus is given below.

Key to Males of *Eurycarenus* Species

1 Eyes widely separated by a distance greater than that between posterior ocelli; tomentum of frons golden; scutellum black. Length of body, 9–11 mm. East, West, Central and SW. Africa . . . . **dichopticus** Bezzi

– Eyes narrowly separated, or in contact at one point, or in contact for a distance subequal to length of ocellar tubercle 2

2 First posterior cell narrowly open, or sessile, or with an extremely short stalk (point-like); eyes in contact for a distance subequal to ocellar triangle; narrow bands of silvery tomentum on hind borders of segments 2 to 6, no trace of white longitudinal stripe. Length of body, 8·5 mm.–9 mm. SW. Africa, S. Rhodesia, Bechuanaland, Ovamboland, Mozambique . . **sessilis** Bezzi (*E. propinquus* Hesse, described on a single female, is probably only a large specimen of *E. sessilis*).

First posterior cell always closed with a comparatively long stalk, very often longer than vein *r–m* 3

3 Abdomen with bristles mainly white, with four transverse and entire white bands, and with a white tip; postalar bristles partly yellowish, third antennal segment with broad base. Length of body, 9·5–10·5 mm. Gambia (Female unknown) . . . . . **albicans** Bezzi
– Bristles of abdomen always black 4
4 Mesonotum predominantly black haired, the yellowish intermingled hairs barely visible; abdomen also predominantly black haired. Length of body, 10·5 mm. Nigeria . . . . . **subater** sp. n.
Mesonotum yellow haired, with only a sprinkling of black hairs (if present); at most only tip of abdomen black haired 5
5 Length 7–9 mm. Scutellum dark or only posterior part reddish; pubescence on mesonotum yellowish, not bright; abdomen without white median stripe. SW. Africa . . . . . **minimus** Bezzi
– Length more than 9 mm. Greater part of scutellum reddish; pubescence of mesonotum mostly bright golden, or bright yellow 6
6 Last three tergites only with dense, erect, black hairs (sides of fourth with a spot of white hairs); white fascia on second tergite complete, that of third narrowly interrupted; hind border of first tergite with black bristles; eyes separated by a very narrow stripe as broad as anterior ocellus, but line between them about as long as ocellar triangle, not point-like; white scaling and hairs on abdomen not erect. Length of body, 12 mm. Zanzibar, N. Nigeria, " Germ. E. Africa " . . . . . **melanurus** Bezzi
– White fasciae on abdomen of different form; hind border of first tergite with white bristles; eyes separated more widely and touching only at one point **Eurycarenus,** other spp.

Eurycarenus sessilis Bezzi

The author has seen 5 ♀♀, SW. Africa: Gobabis, 16–17.xii.1933 (*J. Ogilvie*).

Eurycarenus melanurus Bezzi

German E. Africa: Itigi, 1 ♂, 6.iv.1917 (*G. D. H. Carpenter*).

Sisyrophanus Karsch, 1886

It is noteworthy that the bare face is in some species so densely covered by long hairs on the sides that it is very difficult to see the middle area, and therefore the face appears to be haired. The first posterior cell of the wing is closed and stalked. Usually the stalk is in line with the fourth vein, but sometimes it makes equal angles with the third and the fourth. The alula is not very small. Since the work of Bezzi (1924, *Bombyliidae of the Ethiopian Region*) only one new species, *S.ogilviei*, has been described (Hesse, 1938, *Ann. S. Afr. Mus.* **34** : 526).

Sisyrophanus abdominalis Bezzi

Although the male before me differs in certain small details from Bezzi's description, I consider his identification correct; moreover the locality is the same (Kenya Colony).

Male.—Hairs on first antennal segment not reddish, but yellowish; second segment at least 4 times (not 3 times) shorter than first; black spots on tergites more developed than in Bezzi's specimens, reaching hind border of tergite. All other characters much as in Bezzi's description.

Female.—Very similar to male, but vertex 3 times as broad as ocellar triangle, the latter broad and short; vertex nearly equal to one-third of head width; whole frons shining, very broad, slightly widened to base of antennae, covered with very thin depressed golden and erect black hairs; parafacials from antennal base dusted very dense yellow; hairs on occiput, thorax and abdomen more yellowish than in male; hairs of underside of body white; hairs on tergites scarce, depressed, yellowish, silky; bristles on hind margins long, erect, black and numerous.

1 ♂, 1 ♀, Kenya: Taveta For., viii.47 (*van Someren*); 1 ♀, Karamota, M.P. 29.xii.1933, " from open country with few bushes" (*Miss B. Steele*).

A TAXONOMIC STUDY OF *ANOPHELES FUNESTUS FUNESTUS* GILES (DIPTERA : CULICIDAE) FROM SOUTHERN AND NORTHERN NIGERIA, WITH NOTES ON ITS VARIETIES AND SYNONYMS

By M. W. Service*

(*Malaria Service, Federal Ministry of Health, Lagos, Nigeria*)

Introduction

During two Malaria Control Projects, one at Ilaro, Southern Nigeria (Bruce-Chwatt *et al.*, 1955), the other in Western Sokoto, Northern Nigeria (Bruce-Chwatt *et al.*, 1957), there was some evidence of differences in the reaction of the respective populations of *Anopheles funestus funestus* Giles to spraying by residual insecticides. At Ilaro, which is situated within the zone of dense secondary forest of Southern Nigeria, *funestus* disappeared after a few months of application of B.H.C., while in Northern Nigeria the same species was not eliminated after three years of continuous spraying with B.H.C., D.D.T. and dieldrin. The question then arose as to whether there were in fact two different taxonomic or physiological populations of this specise, one in Southern and one in Northern Nigeria.

In the course of field studies a considerable amount of material was collected, and this coincided with the successful establishment of a *funestus* colony at Yaba (Service and Oguamah, 1958). The difference in behaviour was thought to justify a detailed taxonomic study, especially as no such previous work had covered West African material.

The present paper deals with the comparative taxonomy of two series of *funestus* of the northern and southern populations respectively.

Material

All developmental stages of *A. funestus* were studied and as many specimens as possible were examined, so that a good range of the variability could be obtained.

The southern material was obtained from many localities and included specimens from the colony at Lagos. Care was exercised, however, that the material used from the insectary colony did not differ in any degree from a natural population, *e.g.* in colour or size. The northern material was more restricted in its provenance, coming mainly from Birnin-Kebbi, which is situated at the north-western extremity of Sokoto Province.

Taxonomy

Eggs

It is unfortunate that since no wild material of *funestus* eggs was available, all observations had to be based on the material obtained from the insectary colony. No comparative account can therefore be given.

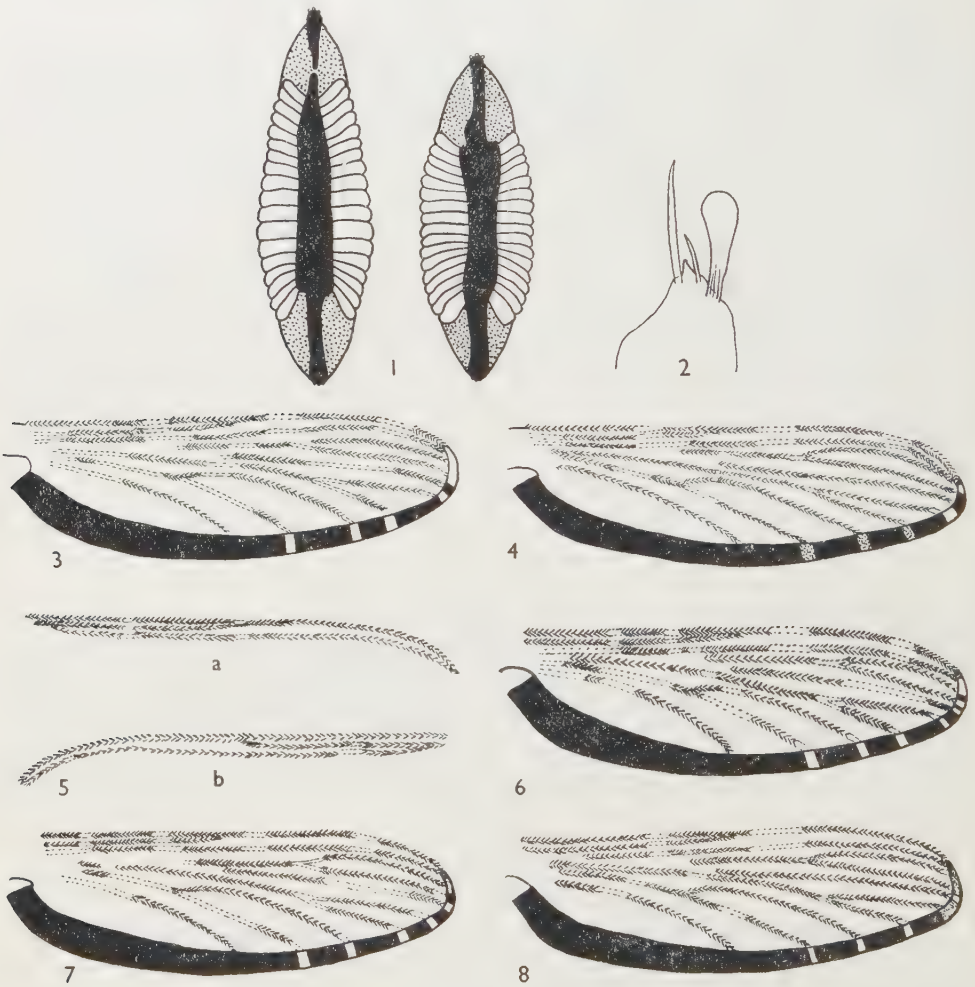
The general morphology of the eggs was in good agreement with the descriptive accounts given by previous authors; but the following differences were found. The convexity of the lower surface of the egg was considerably less than is usually stated, and several irregularities in the symmetrical pattern of the eggs was observed, there being often an irregularity in the shape of the median portion of the upper surface, *i.e.* the deck (fig. 1). In a few cases parts were completely obliterated and an interrupted deck was formed. No mention of this appears to have been made by previous authors.

* *Now at* Malaria Unit, Ministry of Health, Kaduna, N. Nigeria.

Measurements based on 100 eggs from several batches laid by different females are given in Table I.

TABLE I.—*Measurements of eggs of* Anopheles funestus funestus

Egg length in mm.			Egg width in mm.			Length of float in mm.			Length of float in mm./ Length of egg in mm.		
Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean
0·50	0·44	0·48	0·17	0·14	0·15	0·30	0·24	0·28	0·67	0·50	0·57



FIGS. 1–8.—(1–6) *Anopheles funestus* Giles : (1) eggs, showing irregularity of " deck " ; (2) genitalia. harpago and appendages ; (3) pale wing form ; (4) dark wing form ; (5) costa, subcosta and vein 1 of extreme dark northern form (*a*, right wing ; *b*, left wing) ; (6) wing of holotype. (7) *Anopheles hebes* Donitz ; wing of holotype. (8) *Anopheles bisignata* Grunberg, wing of holotype.

The number of ridges in the floats was 15–18.

All the measurements, with the possible exception of the width of the egg (0·13 mm. in Evans, 1938) agree with previous findings.

Larvae

The larval morphology of both northern and southern specimens is quite typical The only character which should be noted is the extent of the development of the free accessory tergal plates on the abdomen. In the present material about 17 per cent. of the wild larvae had some of the paired accessory plates detached from the main tergal plate. These paired plates were either completely separate, or present on the posterior edge of the main plate as two projections. The segment mostly affected was the second, though one larva had them free on segments 5, 6 and 7, but not on segment 2, and one specimen had all three accessory plates free on segments 1–7. Larvae of several generations were examined from the insectary, and only 8 per cent. had the plates detached, and they were found free on any segment from segments 2–7 inclusive. It was usual for a larva having free accessory plates not to have them confined to any one segment but to have them on several ; in one specimen they were free on all but the first and last segments. There does not appear to be such a clear distinction between the number of specimens in wild and colonised material having the accessory plates free as was previously thought (Evans and Symes, 1937).

A Comparison of Southern and Northern Larvae

The results and observations shown in Table II are based on 200 larvae both from the north and south.

Although there are slight differences between the two populations in the degree of branching of various hairs, these are not significant, and there seems to be no clear distinction between the larvae of the two areas.

The presence of an abnormal larvae having three well-developed inner clypeals is noted with considerable interest. This specimen, which was collected in the Cameroons, has the third extra hair as long as the normal two, placed on the inside of the left inner clypeal.

Pupae

The considerably smaller number of pupal pelts from the north prevents any attempt to make a comparative table. However, there was no appreciable difference in the chaetotaxy of the pupal plates of the two populations, and their taxonomic characters are the same and agree with past accounts of *funestus* pelts.

Adults

The adults are quite typical, the only variations being in the degree of pale and dark wing scaling, but these fall within the normal range of variation of the species. In all examined material the pale scales appeared white, and not yellowish or creamy as is often recorded in *funestus*.

In the genitalia the harpago is pointed at the apex to such an extent that a finger-like process is formed, which could easily be mistaken for an apical spine (fig. 2). This character is not well illustrated by Evans and Leeson (1935), Evans (1938), or by De Meillon (1947), but is better shown by King (1932). The inner accessory hair was absent in all the specimens examined ; King (1932), however, records its presence in two specimens from West Africa. The phallosome leaflets are as follows : inner and largest leaflet broad and serrated, followed by three other serrated leaflets, the penultimate one being simple. In all specimens so far examined it appears that only the penultimate leaflet is constantly simple, the others being serrated to a varying degree. Neither Evans (1938) nor De Meillon (1947) mention any absence of serrations on any leaflet, yet both authors give a diagram showing three simple leaflets.

TABLE II.—*The chaetotaxy of the two larval populations of* Anopheles funestus funestus

Characters	Southern	Northern	Remarks
	Head		
Clypeal hairs	All simple	All simple	One southern larva shows three inner clypeals.
Antennal hair	Minute and simple	Minute and simple	
Frontal hairs			
(*a*) Outer	Range : 12–22 branches Mean : 17 ± 2 branches Mode : 19 branches	Range : 13–21 branches Mean : 18 ± 2 branches Mode : 18 branches	
(*b*) Mid	Range : 10–18 branches Mean : 14 ± 1 branches Mode : 14 branches	Range : 11–18 branches Mean : 14 ± 1 branches Mode : 13 branches	
(*c*) Inner	Range : 9–16 branches Mean : 12 ± 1 branches Mode : 13 branches	Range : 10–16 branches Mean : 13 ± 1 branches Mode : 13 branches	
Post-frontal hair	Simple, except in one larva where it was bifid	All simple	Evans (1931) quotes a bifid hair on one side of larva from S. Rhodesia and De Meillon (1933) gives a case of a 4-branched hair.
Vertical hairs	Range 2–4 branches Majority 2 or 3 branched	Range 1–5 branches Majority 2 or 3 branched	
Outer occipital hairs	2 or 3 branches	2 or 3 branches	No other number ever discovered.
Inner occipital hairs	All single	All single	
	Thorax		
Submedian hairs			
(*a*) Inner	Range : 13–26 branches Mean : 19 ± 3 branches Mode : 18 branches	Range : 15–26 branches Mean : 19 ± 2 branches Mode : 17, 19 branches (bimodal)	
(*b*) Mid	Range : 10–17 branches Mean : 14 ± 2 branches Mode : 13 branches	Range : 10–20 branches Mean : 15 ± 2 branches Mode : 13, 14 branches (bimodal)	
Thoracic palmate hairs	Range : 12–19 leaflets Mean : 14 ± 3 leaflets Mode : 13, 14 leaflets (bimodal)	Range : 10–20 leaflets Mean : 13 ± 2 leaflets Mode : 13 leaflets	
	Abdomen		
Palmate hairs			
(*a*) 1st seg.	Range : 8–15 leaflets Mean : 10 ± 2 leaflets Mode : 10 leaflets	Range : 10–14 leaflets Mean : 12 ± 1 leaflets Mode : 12 leaflets	
(*b*) 5th seg.	Range : 17–25 leaflets Mean : 22 ± 2 leaflets Mode : 23 leaflets	Range : 19–25 leaflets Mean : 22 ± 1 leaflets Mode : 22 leaflets	
Tergal plates	Width/depth ratio on seg. V from 1·99–2·47 ; mean ratio 2·17 ± 0·17	Width/depth ratio on seg. V from 1·86–2·21 ; mean ratio 2·04 ± 0·09	

A Comparison of Southern and Northern Adults

The following comparative account is based on about 100 females from the north and south respectively, except that in the genitalia and pharyngeal armature about ten specimens only from each population were used.

Head

There are no differences in the chaetotaxy or scaling of the head between southern and northern forms ; nor is there any difference in the extent of the banding of the female palps, all being narrow banded. All pale scaling is white, not yellow. The pharyngeal armature is identical in specimens from both localities.

Thorax

The vestiture of the thorax is the same in both southern and northern forms. It is only in the wings that any differences between the two populations can be seen. Specimens from Ilobi, Southern Nigeria, and Mamfe, Southern Cameroons, all belong to Leeson's Group I (1930), except one specimen from Ilobi, which belongs to De Meillon's Group *d* (1933), *i.e.* having a pale basal interruption, and one specimen from Mamfe which belongs to De Meillon's Group *a*, also with a pale basal costal interruption, but with the middle area of vein 3 pale scaled. Specimens from Enugu consisted mainly of dark scaled individuals, but a few light adults were also found ; all, however, belong to Leeson's Group I, and two or three of the light scaled specimens had a small pre-accessory spot on vein 1. Of the insectary adults, which were originally obtained from the south at Yaba, all belong to Group I of Leeson, but, unlike the previous specimens, nearly all are pale forms (fig. 3). Out of 40 specimens examined, 32 have the fringe from veins 1–3 entirely white scaled. Vein 3 has a white area in all except six specimens, in which it is entirely dark scaled, and vein 6 is white scaled basally except in three specimens which have vein 6 entirely dark.

Of the northern material from Birnin Kebbi, all except one specimen described later, belong to Leeson's Group I and can be termed dark forms (fig. 4), *i.e.* vein 6 dark, vein 3 dark, and reduced pale scaling on veins 2, 4 and 5, the fringe spot opposite veins 4 and 5 being obscure. Nine specimens, although of Group I, differ from the above in having the stem of vein 5 entirely dark. Another six specimens, although generally of a dark form, have a white area on vein 6 corresponding to the white area on the stem of vein 5. Specimens from Lokoja, Northern Nigeria, also belong to Leeson's Group I and are dark forms, but a few possess a white area on vein 3, situated just beyond the middle of the vein. The wing groups and their localities are given in Table III.

Table III.—*Wing characters of* Anopheles funestus funestus

Dark area at base of costa	Vein 3	Vein 6	Grouping	Locality
Uninterrupted . .	All dark	All dark	Leeson I (1930)	Birnin Kebbi.
Uninterrupted . .	All dark	Pale basally	Leeson I (1930)	Birnin Kebbi.
Uninterrupted . .	All dark or pale beyond middle	All dark	Leeson I (1930)	Lokoja.
Uninterrupted . .	All dark	All dark	Leeson I (1930)	Ilobi, Mamfe, Enugu, Yaba (Insectary).
Interrupted by one pale area	All dark	All dark	De Meillon *d* (1933)	Ilobi.
Interrupted by one pale area	Pale beyond middle	All dark	De Meillon *a* (1933)	Mamfe.
Uninterrupted . .	Pale beyond middle	Pale basally	Leeson I (1930)	Yaba (Insectary).
Uninterrupted . .	Pale beyond middle	All dark	Leeson I (1930)	Enugu.

Abdomen

No differences are seen in the general integument of the abdomen of the two populations or in the genitalia.

Variation

One specimen from the north differs from all other material in having extremely dark wing scaling. On the right wing there are two very indistinct white spots, *P*1 and *P*2 on the costa; the subcosta has *P*1 only, and vein 1 has both (fig. 5*a*). The left wing differs in having the costa entirely dark scaled, the subcosta as in the right wing, and vein 1 with pale spot *P*1 only (fig. 5*b*). In both wings veins 3 and 6 are entirely dark scaled, and vein 2 has the fork and stem dark, except at its junction and at the cross-vein. Vein 4 has a small patch of white scales in the middle of its stem, vein 5 has a similar patch and also one on its lower fork. White fringe spots are present opposite the endings of veins 1 and 2; other fringe spots are very indistinct.

Synonyms

There is often a great deal of difficulty with well worked anophelines, in the taxonomic status of described varieties and synonyms. This is usually complicated by changes involving the value of salient generic and specific characters, and by poor descriptions which are given taxonomic status. Too often in the past mere variations from the type form have led to a multitude of varietal names, and this is particularly so in species such as *funestus*, which is truly polymorphic in the adult state. It then becomes difficult to decide whether such described forms are in fact separate entities or only variations within the species range. Major G. M. Giles, in February, 1900, gave the first description of *funestus*, and the accompanying figure of the wing (fig. 6) is of the female holotype, which is at the British Museum (Nat. Hist.). In November, 1900 Chalmers, who held the position of assistant surgeon in the British Army, described an *Anopheles* from Kumasi, Gold Coast, which he named *A. kumasii* sp. n. No types exist, as all his specimens were lost in the march to the coast, and he apparently had no time to make drawings. His description is extremely poor, but nevertheless all the characters which he does mention are in agreement with *funestus*. He also states that this small black mosquito was a house dweller, and that " it frequently contains the malaria germs in its stomach ". There is little doubt that what he described was, in fact, *funestus* Giles and it is probable that he never saw the description given by Giles nine months earlier.

Anopheles hebes Donitz was described in 1902 from material from West Africa. A translation by Miss Falcke of the type description is given in Theobald's *Monograph of the Culicidae of the World*, 1903. Through the kindness of Dr. F. Peus of Berlin, I have been able to examine both the types of this species and of *A. bisignatus*. The type of *hebes* agrees in all characters with *funestus*. The wing (fig. 7) is a pale form having a basal costal interruption and differing little from Giles' holotype. There is, however, a great discrepancy in the description of the female palps. The female palps of the *Anopheles* in 1903 were considered to be four-segmented. Hence segment 1 is in reality segments 1 and 2, segment 2 is segment 3, segment 3 is segment 4, and the last segment is in reality segment 5. The type description, as translated by Falcke, states that joint 4 (*i.e.* 5) is all white, joint 3 (*i.e.* 4) is dark scaled and that joints 1 and 2 (*i.e.* 2 and 3) are covered with white scales. This description does not agree with the type specimen, which, as in *funestus*, has segments 1 and 2 (using 1903 nomenclature) dark scaled, with only the apex of 2 pale. Photostat copies of the German original description were sent to H. F. van Emden for translation. His translation is very similar to that given by Falcke, except that he translates " glied " as segment and not as joint. There are two possible explanations, one that Donitz

described his material incorrectly, the other that he employed the same word for the whole segment and for the joint between the segments. If this is in fact true, then he probably meant that the joints between segments 1 and 2, and 2 and 3 were white, and that segment 3 was dark, and segment 4 entirely white scaled. Taking this into account, there is little to justify placing *hebes* as anything but a synonym of *funestus*.

Grunberg, in 1905, described *Anopheles bisignatus* from West Africa. On examination of the type specimen, it was seen to agree in all details with the dark winged forms of *funestus* (fig. 8). The fringe spots are small and indistinct, there is no basal costal interruption, vein 3 is totally dark scaled and the main dark areas 3 and 4 are fused. This is similar to the varietal form from the north, as described earlier in this paper and, although Edwards (1932) treats *bisignatus* as a named variety, there is very little evidence to support this. It is better to regard it as a dark winged form of *funestus* and the name *bisignatus* as a true synonym.

Theobald, in 1903, named two varieties of *funestus* namely, var. *umbrosus* and var. *subumbrosus*. The types were deposited in the Liverpool School of Tropical Medicine and Hygiene, but cannot now be traced. Below is the description of *umbrosus* as given by Theobald.

" Costa black at the base, unbroken by the typical small pale spot. Veins with the dusky scales predominating ; the pale scaled areas restricted to the region of the cross-veins and base of the fork-cells and on the fifth long vein ; *the third long vein dark as in* rhodesiensis. Wing fringe spotted as in the type but not so prominently." Without the type or any drawings it is difficult to determine the status of this varietal form ; however, it appears fairly clear that the wing is similar to that shown by Evans (1938), which is classified as a dark form of *funestus*.

The following is Theobald's account of *subumbrosus*.

" Costa black at the base, unbroken by any pale spot. Dusky scales predominating, but not contrasted as in the type with the pale scale areas. *Third long vein pale-scaled in the middle*, and pale scaled areas also on the fourth, fifth and sixth."

There is certainly no evidence that *subumbrosus* is a variety ; it appears to be a light winged form, differing from the holotype mainly in lacking the pale basal costal spot.

Conclusion

In the adults the pharyngeal armature and the genitalia are identical in both southern and northern material. There are, in fact, no reliable differences between the two populations except in the scaling of the wings of the adults. Any other small differences are not significant statistically, and merely illustrate either slight degrees of individual variation, or the ends of a range of variability.

It must be remembered that the use of morphological differences in determining species is only a guide, though in most cases an extremely good one. The absence of a morphological difference between southern and northern populations of *funestus* does not exclude the presence of cryptic species ; it is well known that *funestus* is a polymorphic species. We have as yet little information on the susceptibility or resistance of *funestus* to residual insecticides within the vast area between the two localities, Birnin-Kebbi and Ilaro. It is reasonable to suppose, and there is evidence to support it, that *funestus* extends from the north of Nigeria to the south in a series of demes or populations, and that these are not morphologically different. It is not known whether these demes in between the two extremes show susceptibility or resistance, nor whether the whole range of *funestus* is a single inter-breeding population or, as is more likely, several demes that do not necessarily inter-breed in nature but are nevertheless capable of doing so. All that can be said at present is that the two morphologically indistinguishable populations of *funestus*, one from the south and the other from the north, react differently to spraying with insecticides.

No figures of resistance-levels of southern *funestus* are available for a comparison with northern material (Ramakrishna and Elliott, 1957) ; so, although field observations seem to indicate that there may be two different strains of *funestus*, one more susceptible than the other, there are no precise figures to support this.

Acknowledgments

I am indebted to Sir Samuel L. A. Manuwa, C.M.G., O.B.E., Chief Medical Adviser to the Federal Government of Nigeria, for permission to publish this paper. My sincere thanks and appreciation go to Dr. L. J. Bruce-Chwatt, O.B.E., Mr. P. F. Mattingly, Dr. De Meillon, Dr. F. Peus and to Dr. H. F. van Emden for their kind help, and for the loan of specimens and translations of reprints.

References

Bruce-Chwatt, L. J., Archibald, H. M., Elliott, R., Fitz-John, R. A. and Balogun, I. A., 1955, An experimental Malaria Control Scheme in Ilaro, semi-rural holoendemic area of Southern Nigeria. Results. 1949–1953. *Inf. Bull. Gaskiya Corp.* **3** : 1–70.

Bruce-Chwatt, L. J., Archibald, H. M. and Haworth, J., 1957, Malaria Control Pilot Project in Western Sokoto (N. Nigeria). *Ann. Rep.* **3** : 1–55.

Chalmers, A. J., 1902, *Anopheles kumasii* sp. nov. *Lancet* **1902** (ii) : 1262–3.

De Meillon, B., 1933, On *Anopheles funestus* and its allies in the Transvaal. *Ann. trop. Med. Parasit.* **27** : 83–97.

—— 1947, *The Anophelini of the Ethiopian geographical region.* (Publ. S. Afr. Inst. med. Res. **49**).

Donitz, W., 1902, *Anopheles hebes* sp. nov. *Z. Hyg.* **41** : 84–85.

Edwards, F. W., 1932, *In* Wytsman, P., *Genera Insectorum.* **194**. *Diptera : Culicidae.* Bruxelles.

Evans, A. M., 1931, A new subspecies of *Anopheles funestus* Giles, from Southern Rhodesia. *Ann. trop. Med. Parasit.* **25** : 545–9.

—— 1938, *Mosquitoes of the Ethiopian Region. II. Anophelini, adults and early stages.* London : British Museum (Nat. Hist.).

—— and Leeson, H. S., 1935, The *funestus* series of *Anopheles* in Southern Rhodesia with description of a new variety. *Ann. trop. Med. Parasit.* **29** : 33–47.

—— and Symes, C. B., 1937, *Anopheles funestus* and its allies in Kenya. *Ibid.* **31** : 105–12.

Giles, G. M., 1900, *Anopheles funestus* sp. n. *Mem. Lpool. Sch. trop. Med.* **2** : App. 2 : 50–51.

Grunberg, K., 1905, Zur Kenntnis der Culicidenfauna von Kamerun und Togo. *Zool. Anz.* **29** : 377–90.

King, W. V., 1932, Three Philippine *Anopheles* of the *funestus-minimus* subgroup. *Philipp. J. Sci.* **48** : 485–524.

Leeson, H. S., 1930, Variations in the wing ornamentation of *Anopheles funestus* Giles. *Bull. ent. Res.* **21** : 421–8.

Ramakrishna, V. and Elliott, R., 1957, Normal resistance-level of *Anopheles funestus* Giles to insecticides. *Nature, Lond.* **179** : 1140–1.

Service, M. W. and Oguamah, D., 1958, Colonization of *Anopheles funestus*. *Ibid.* **181** : 1225.

Theobald, F. V., 1903, *A Monograph of the Culicidae or mosquitoes.* III. London : British Museum (Nat. Hist.).

PUBLICATIONS

The principal Publications of the Royal Entomological Society are *Transactions* and *Proceedings*.

The **Transactions** form an annual volume, each paper in the volume being issued as a separate part. The parts are issued irregularly throughout the year.

The **Proceedings** are issued in three series:

Series A.	**General Entomology**
Series B.	**Taxonomy**
Series C.	**Journal of Meetings**

Series A and B are issued in twelve parts, forming an annual volume of approximately 240 pages each.

The following information is supplied for the guidance of authors wishing to submit papers for publication in any of the Society's journals.

TRANSACTIONS

Papers offered for publication in the *Transactions* are considered by the Publication Committee of the Society which meets usually in the months of May and November. In order that papers may be considered at these meetings it is necessary for the manuscript and drawings for illustrations to be in the hands of the Registrar as early as possible. Papers received *after* 1st April and 1st October cannot be considered at the meeting immediately following.

The Society is prepared to undertake the provision of a reasonable number of figures, in line or half-tone. Colour work is accepted only by special arrangement.

Papers of less than eight printed pages (approximately 5,000 words) will not normally be accepted for the *Transactions* and papers by authors who are not Fellows of the Society must be communicated by a Fellow.

PROCEEDINGS SERIES A AND SERIES B

Papers submitted for publication in either *Series A* or *Series B* of the *Proceedings* are considered by the Editor and may be submitted at any time. Papers by authors who are not Fellows of the Society may be accepted if they are communicated by a Fellow.

Line blocks will be provided by the Society. Half-tone and colour work are accepted only by special arrangement and the author may be required to pay for the blocks.

PROCEEDINGS SERIES C

Series C is issued before every General Meeting. It contains abstracts of communications to be made, together with the titles of papers accepted for publication in the *Transactions*.

The annual subscription to *Series A, General Entomology*, is £2 8*s*. 0*d*.; *Series B, Taxonomy*, £2 8*s*. 0*d*.; and *Series C, Journal of Meetings*, £1 0*s*. 0*d*.

As from January, 1936, the journal *Stylops* is continued as *Proceedings Series B, Taxonomy*. Copies of volumes 1–4 are available at £1 16*s*. 0*d*. each, post free.

GENERAL

The original drawings for all figures must be supplied by authors and must be drawn to a scale which will permit of their reduction, singly or after grouping, to an area of dimensions not exceeding 7 by $4\frac{1}{2}$ in.

A uniform method is adopted for the citation of bibliographical references in the Society's publications as follows:

SMITH, A., 1936, New species of Coccidae. *Proc. R. ent. Soc. Lond.* (B) **6**: 301–6, pl. 1.

—— 1936, New species of Coccidae. *Trans. R. ent. Soc. Lond.* **84**: 901–36.

Titles of periodicals cited are to be abbreviated in the manner indicated in the *World List of Scientific Periodicals, 3rd edition*, 1952.

Authors are entitled to receive 25 copies of their papers free of charge and may purchase additional copies provided that request be made before publication.

Papers offered for publication should be sent to the Registrar, Royal Entomological Society of London, at 41, *Queen's Gate, London, S.W.*7, and must be typewritten on one side of the paper only, with double spacing. **All papers in the Transactions must be provided with a summary.**

All the Society's publications are copyright.

MEETINGS

TO BE HELD IN THE SOCIETY'S ROOMS
41, Queen's Gate, S.W.7

1960

Wednesday, July 6
„ October 5
„ November 2
„ December 7

THE ROYAL ENTOMOLOGICAL SOCIETY OF LONDON

The Fellowship and Fees

Fellows pay an Admission Fee of £2 2*s*. The Annual Contribution, £3 3*s*., is due on the first day of January in each year, and is payable in advance. Fellows under the age of 25 years on the date of election are exempt from the payment of the Entrance Fee.

Fees should be paid to the Registrar, at 41, Queen's Gate, S.W.7.

Fellows desiring to pay their Annual Contribution through their bankers may obtain an official form of bankers' order by applying to the Registrar.

Fellows whose Contributions for the current year have been paid are entitled to receive the *Transactions* and *Proceedings* of the Society free of charge. Further copies may be purchased at reduced prices by applying to the Registrar.

Forms of application for Fellowship, copies of the Bye-Laws and the List of Fellows may be obtained from the Registrar.

Meetings and Exhibitions

Fellows and others wishing to make a communication to a General Meeting of the Society are requested to send in their names, the title of their exhibit, and a short abstract of their remarks, to the Hon. Secretary fourteen days before the meeting at which it is proposed to make the communication. Should it be desirable to publish a fuller account of the communication the manuscript may be submitted for publication in *Proceedings Series A* or *Series B*.

Fellows resident abroad, or otherwise unable to attend meetings, are reminded that notes or observations sent to the Hon. Secretary may be communicated to a General Meeting on their behalf.

PRINTED FOR THE SOCIETY BY ADLARD AND SON, LTD., BARTHOLOMEW PRESS, DORKING.